HANDHELD DETECTOR OF SEMICONDUCTOR COMPONENTS

« L O R N E T »

USER MANUAL
CERTIFICATE

USER MANUAL

1. Introduction

A handheld detector of semiconductor components «LORNET» (further the detector) is used for search and detection of electronic devices both in active and switch-off state.
Operating of the detector is based on the property of semiconductor components re-emit the 2nd and the 3rd harmonics when radiating them by a probing UHF signal. It is assumed that maximum response time of semiconductor components of artificial origin is at the 2nd harmonic of the probing signal. When radiating oxide films of natural origin maximum response time is at the 3rd harmonic of the probing signal.
«LORNET» detector enables to make analysis of the response time of the objects radiated both by the 2nd and the 3rd harmonics of the probing signals giving the possibility to identify electronic devices and natural oxide semiconductors reliably.
«LORNET» finds the best receiving frequency channel free from noise automatically enabling to operate the device in complicated electromagnet conditions. Algorithm of frequency tuning used in «LORNET» chooses frequency of the probing signal automatically in such point that noise level is minimum in the receiving channel of its 2nd harmonic.
Digital processing of a demodulated signal used enables to get maximum sensitivity.
There are two types of the signals emitted:

- Continuous wave of carrier frequency (CW);
- Pulse modulation of carrier frequency with pulse ratio of 100 (Pulse).

This enables to combine long detection range and reliable identification of the devices found.
Mode of automatic control of output power simplifies actions of an operator.
«LORNET» can display signal levels of the 2nd and the 3rd harmonics at LED panel simultaneously. Besides, level of the 2nd or the 3rd harmonics can be estimated in turn aurallyby by click repetition rate, reproducing via a built-in loudspeaker or wireless earphones.
Presence of the detector of an envelope curve of UHF signal re-emitted enables to tap active microphones and to use acoustic-binding for easy search.

2. Technical Parameters.

2.1. Types of the signal emitted:

- Continuous wave of carrier frequency;
- Pulse modulation of carrier frequency with pulse ratio of 100.

2.2. Carrier frequency is fixed with pitch of 0.2 MHz within 890 … 891 MHz. Frequency selection is automatic. Possibility of emitting at carrier frequency with minimum noise in a path of the receiver of the 2^{nd} harmonic is provided.

2.3. Maximum emitting power in CW mode does not exceed 2 W.

2.4. Peak power in a pulse mode does not exceed 10 W.

2.5. Emitting power is controlled automatically or manually using a built-in attenuator. Dynamic control range is 30 dB from maximum value of output power, and is separated into 11 levels.

2.6. Real sensitivity of receivers is not worse than minus 150 dBW.

2.7. Tuning frequencies of receivers are equal to double and triple frequencies of a transmitter.

2.8. Dynamic range of the receiving path is less than 70 dB.

2.9. Time of continuous operating with lithium-Ion battery at maximum emitting power is not less than:

3 hours for pulse mode (Pulse)

and 1.5 hours for CW mode (CW).

At minimum emitting power time of continuous operation increases about two times.

2.10. Weight of the device equipped does not exceed 1.1 kg.

2.11. Operation condition:

- ambient temperature 5÷40 ºC.
- pressure is not less than 450 mm of mercury

3. Structure Of The Device, Design And Accessories

3.1. The device consists of the units and accessories listed in the Table:

Name	Q-ty
A receiving-transmitting antenna unit combined with an indicator	1
A telescopic arm with a control panel and a battery	1
A mains charger for batteries	1
Additional batteries	1
Wireless telephones	1

Fig. 1

Appearance of the device is shown in Fig. 1, where:

1- LED indicator;

2- A receiving-transmitting antenna unit combined with an indicator;

3- A telescopic arm;

4- A control panel with a power section and a battery (attached below).

Wireless earphones, chargers and additional batteries are not shown in the figure.

4. Purpose Of Basic Units Of The Detector

4.1. A receiving-transmitting antenna unit with built-in LED indicators (shown in Fig. 2) is used for:

- Analysis of interfering load of receiving path of the device, which is made at each turn-on of the detector transmitter. Therefore, during operating when an interfering signal appears (under complicated electromagnet conditions) it is necessary to turn the detector transmitter off and then to turn it on from time to time, hence selecting optimum frequency automatically, enabling the best sensitivity and detection range of semiconductor components.
- Formation of CW or pulse UHF signal.

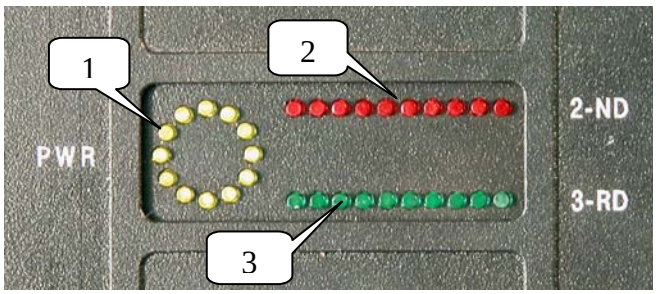

Fig.2

- Receipt and digital processing of the 2nd and the 3rd harmonics of frequency. Simultaneous display of signal levels of the 2nd and the 3rd harmonics enables to differ signals of artificial semiconductors, which are a part of electronic devices, from natural corrosive ones, appearing at oxidation of connecting points of various metals, for sure.

- Demodulation of response time of the 2nd and 3rd harmonics, their amplifying to the level required for tapping both to earphones and inner dy-

namic. The possibility to control amplification at 20 dB is provided. Tapping of demodulated signals of the 2nd and 3rd harmonics is made by an operator in turn.

- Display of levels of a probing signal (1), signals of the 2nd (2) and 3rd (3) harmonics (Fig. 2).

4.2. Hinge joint of the receiving-transmitting antenna unit with a knob is designed for transformation the unit into transportation position. (see Fig.3). Besides, it helps an operator to fix antenna position convenient for search.

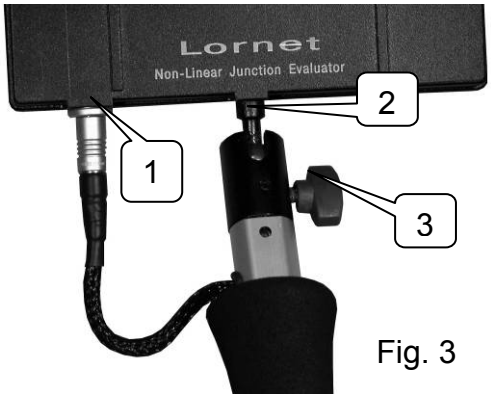

Fig. 3

Fig. 3:
1- Connector for electric cable;
2- Hinge joint;
3- A knob of a hinge.

4.3. A control panel is used to control operating of the detector. It consists of a case combined with a battery and fixed on the telescopic arm. A control board, buttons for operating modes control and display LEDs are in the case. Control buttons are divided into two groups by functional feature: «AUDIO» placed in the upper half of the panel and «POWER RF» in the , lower part. Control panel is shown in Fig.4

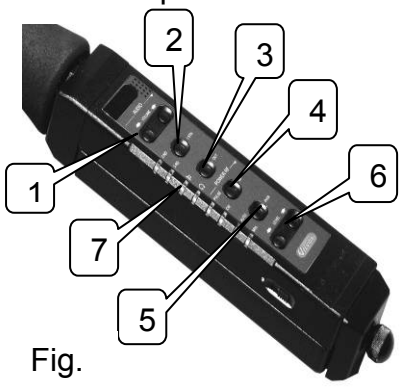

Fig.

The following buttons are referred to «AUDIO» group:

1- **Volume** buttons for volume control (⇑ - high, ⇓ - low).
2- **LSTN** button for switching of acoustic display to output on the 2nd or 3rd harmonics.
3-**OUT** button for switching acoustic output to earphones or a built-in loudspeaker.

The following buttons are referred to «POWER RF» group:

4-**RF** button for switching emission types of a probing signal (CW – continuous, PULSE – pulse).
5-**PWR** button for turn on/off a transmitter of the probing signal. When it is turned on an automatic mode of output power control (AUTO) is set by default. To switch over to a manual mode of output power control (MNL) press one of **LEVEL** buttons when a transmitter is turned on. To return to an automatic mode turn a transmitter off and then turn it on.
6-**LEVEL** buttons for control of emitted signal power in MNL and AUTO modes (⇑ - high, ⇓ - low). It is possible to set maximum power level by pressing **LEVEL** button (⇑ - high, ⇓ - low) in AUTO mode before a probing signal transmitter is turned on.
7-An indicator line of current modes. Continuous light of the indicator corresponds to «ON» position, absence of light – «OFF» position. Light of 2nd and 3rd indicators means that only the detector receivers

work, and a probing signal transmitter is off. When a transmitter is turned on, 2nd mode is set on default. Simultaneous flickering of all indicators on the panel shows that a battery is discharged, it needs to be replaced.

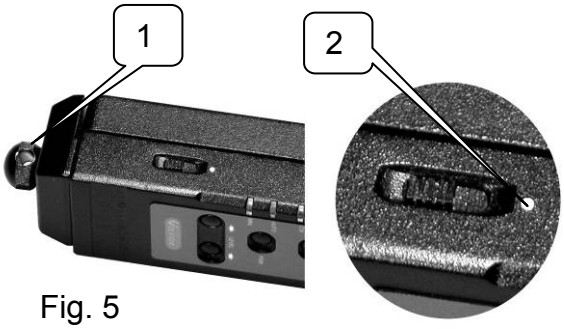

Fig. 5

4.4. On the side surface of the control panel (see 1 in Fig. 5) a slide-type power switch is placed. A slide position corresponding to «ON» is marked by a contrast point (see 2 in Fig.5).

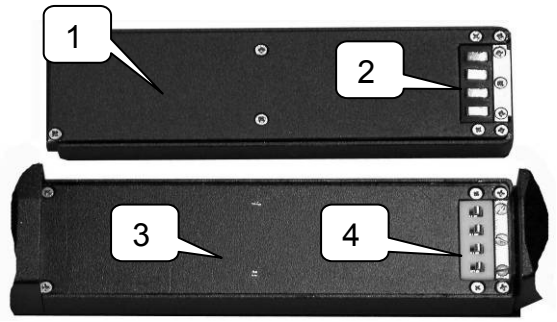

Fig. 6

Power battery in the removed state is shown in Fig.6 where:

1- removed battery (back side);
2- contact group of a battery;
3- back side of the control panel (a socket for a battery);
4- a contact group of the control panel.

The connection order of the battery is shown in Fig.7. To install a battery into a socket a battery should be placed in such a way that battery contact groups and sockets are placed opposite, and a battery hook comes into a socket catch without any warp.(see 1 in Fig.7). Then, towards a pointer without extra efforts put a battery into a socket till a retainer clip clicks. To remove a battery do the above mentioned actions in reverse order.

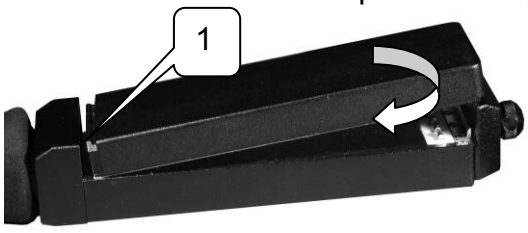

Fig. 7

4.5. Batteries charging is made by a mains adaptor and mains charger for batteries included into delivery set. Appearance of the charger is given in Fig. 8
The installation order of a battery into a charger is shown in Fig. 7.

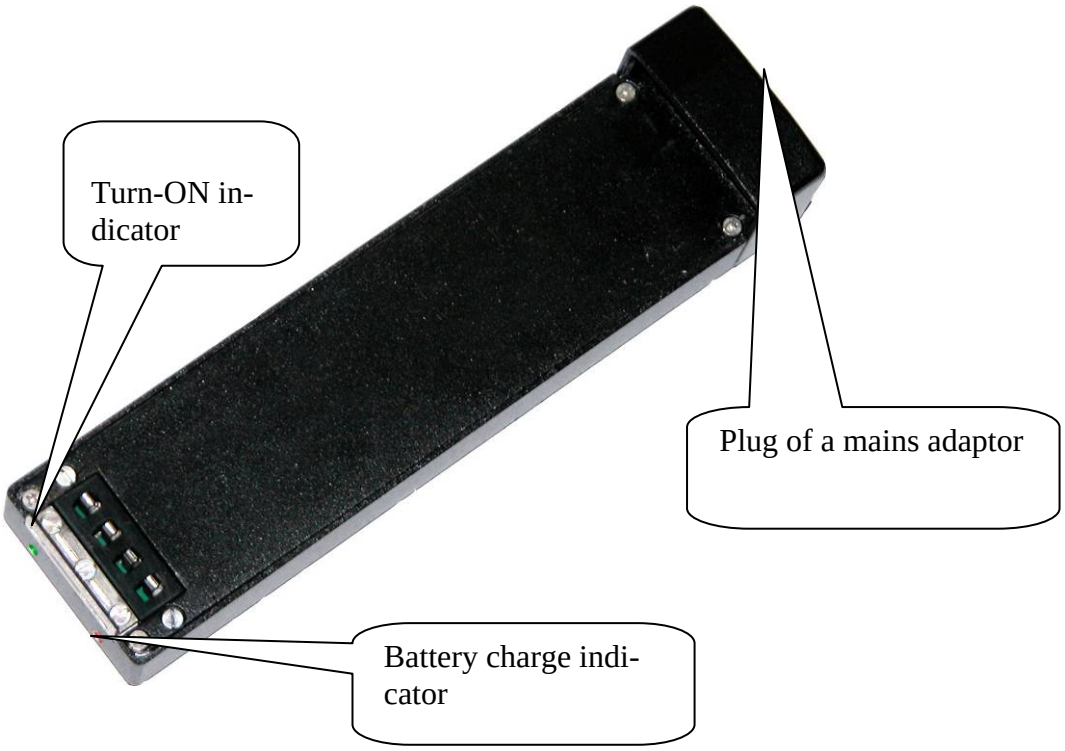

Fig.8

To charge a battery set a battery into a charger, connect a mains adaptor to the charger and to the mains. When a charger is turned on a green LED lights. While charging a red LED lights which goes out when a battery is fully charged. Charging time of the battery fully discharged is about two hours.

Wireless telephones consist of a receiving device and earphones.

Appearance of a receiving device and position of control units are shown in Fig.9

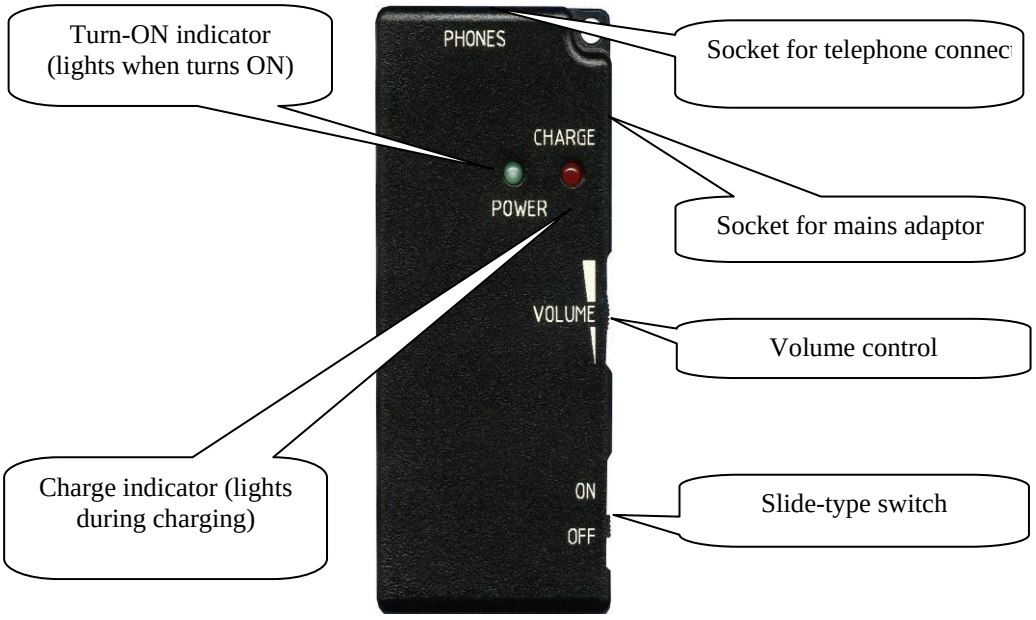

Fig. 9

Operating order of a receiving device.

- Using a mains adaptor included into delivery set, make full charging of a built-in battery by charge indicator.

Use of another mains adaptors are forbidden.

- Connect head phones through a corresponding socket of a receiving device.
- Turn a receiving device ON by a slide-type switch (control by a turn-ON indicator).
- Using volume control set comfortable volume level.
- If a receiving device is turned on when the detector is off, then there is only a noise signal in the head phones at higher volume. After turning on acoustic indicator signals corresponding to operating mode of the detector appear in the earphones.

5. Safety Measures

5.1. By requirements of electric safety the detector is referred to protection class 1.
5.2. Persons having taken instructing for safety measures while operating electric devices and measuring devices with open radiators of RF-energy are permitted to work.

6. Operating Order.

6.1. Remove the detector from the package, and a battery from a protective case, connect a battery to the detector. While transporting the device at negative temperature it is necessary to keep the device at room temperature not less than 30 min, not turning the device on.
6.2. To start operating the device turn «LORNET» on by a power switch placed on the control panel (Fig.5). At that 2^{nd} and 3^{rd} indicators on the control panel light, indicating that power of the detector is turned on.
One yellow LED should light on the antenna unit (a circle scale of power indicator of the probing signal). Its initial position corresponds to maximum power of the probing signal. Here a probing signal transmitter is off (it is turned on after pressing PWR button only).
Indicators of the 2^{nd} and 3^{rd} harmonics should not light (flashing of the first LEDs of 2^{nd} and 3^{rd} of scales is permitted).
Turn a probing signal transmitter on pressing PWR button. Here a pulse mode of the transmitter and an automatic mode of signal power change. In the given mode sound information of the 2^{nd} harmonic signal response is put to the dynamic or head phones.
To switch over to manual mode of power control of the probing signal (MNL indicator lights) press one of **LEVEL** buttons after a probing signal transmitter is turned on. Turn a probing signal transmitter off and then turn it on for reverse switch over.
If necessary to tap a response signal by the third harmonic turn 3^{rd} mode on using LSTN button on the control panel.
Normally while operating in rooms with a lot of electronic devices, decrease level of the probing signal for 2-4 points counterclockwise from the initial one. Optimum level of the probing signal is reached by experimental way.

6.3. Simultaneous flashing of all indicators on the control panel indicates that a battery is discharged and need to be replaced urgently. At that power should be turned off and a battery - replaced.
6.4. If a response signal for telephones needs to be tapped, switch over acoustic indication in a mode of head phones, for that press the corresponding button on the control panel (see 2 in Fig.6) and turn wireless phones on (according to their User Manual).

Attention:

1). Do not direct the antenna towards an operator and people nearby.

2). While operating the device observe state of batteries constantly replacing them in-time (by the indicator signal). The batteries must be kept in a charged state.
3). Charging should be done in a charger only, included to the delivery set.
4). Independent assembly/disassembly and use of undue chargers are forbidden.
5). When work is over or break in operating is too long, it is recommended to remove a battery from the detector.
6). To avoid short-circuit of leads (see 2 in Fig.8), in non-use state, batteries are to be in isolating case.

7. Search Recommendation

7.1. If possible remove electronic devices from the room examined. If it is impossible examination should be done at decreased power emitted.
7.2. Set maximum power emitted and one of the operating modes of the receiver.
7.3. Place antenna unit parallel to the surface examined at the distance not exceeding 10 cm.
7.4. Slowly moving antenna unit parallel to the surface examined and changing orientation of antennas, analyze change of nature of the signal received by the 2^{nd} and 3^{rd} harmonics by the indicator visually (aurally click repetition rate should be maximum).
7.5. Analysis of levels of the receiving signal reflected by the 2^{nd} and 3^{rd} harmonics is made by number of LEDs lit on the corresponding indicator scale.
7.6. Remove antenna unit from the surface examined or decrease output power and repeat measurements stated in cl.7.4. of the present manual.
7.7. When artificial p-n transition is found, as a rule, stable glowing of the indicator LEDs by the 2^{nd} harmonic of the signal reflected. While rapping a supposed place of p-n transition, readings of LEDs do not change.
7.8. When natural p-n transition is found, there is stable light of LEDs of indicators by the 3^{rd} harmonic of the signal reflected. While rapping the surface examined intensively, readings of indicators by the 3^{rd} harmonic do not change, as a rule.
The search technique offered does not contain all nuances in exact cases, and it is a recommendation only.

CERTIFICATE

1. General

1.1. Before operating study User Manual for «LORNET» thoroughly.
1.2. The Certificate is included to the delivery set and should be always near it.
1.3. If the device is sent for repair or other place during operation the Certificate is to be passed with the device.
1.4. Marks in the Certificate should be done in-time.
1.5. All records in the Certificate should be made by ink only, distinctly and carefully. Erasures, blots and corrections unauthorized are not permissible.
1.6. It is forbidden to make any notes or records on fields and a cover of the Certificate.

2. Delivery set

Name	Q-ty	Serial No	Notes
A receiving-transmitting antenna unit	1		
A telescopic arm with a control panel and a battery	1		
A charger for a battery	1		
A mains adaptor	1		
A battery	1		
Wireless phones included: a receiver and earphones	1		
User manual	1		In one piece
Certificate	1		
Package	1		

3. Warranty

3.1. Warranty period of «LORNET» detector is 18 months upon supply to the customer.
3.2. Life time is 6 years.
3.3. If the device fails during warranty period provided the customer follows all rules for operation, transportation and storage, the manufacturer is to make repair free of charge or replace the device.
3.4. Warranty does not cover power elements.

4. Acceptance Certificate

A C C E P T A N C E C E R T I F I C A T E

Handheld Detector of
Semiconductor Components «LORNET» (name) No _____ (serial number)

is manufactured and accepted according to obligatory requirements of state standards, current technical documentation and fit for service.

Technical inspection

stamp

_____ (signature) _____ (signature clarification) _____ (date, month, year)

5. Package Certificate

P A C K A G E C E R T I F I C A T E

Handheld Detector of
Semiconductor Components «LORNET» (name) No _____ (serial number)

Packaged by:

according to the requirements stated in the given technical documentation.

____ (title) _____ (signature) _____ (signature clarification) _____ (date, month, year)

6. Claims Data

In case of package damage during transportation claims are put in to the transportation organization in the order stated.
If delivery set is not complete or handheld detector of semiconductor components «LORNET» is damaged, provided a package is not damaged, Act is made together with a representative of the manufacturer.
If a defect appears during warranty period, a customer is to send handheld detector of semiconductor components «LORNET» to the company-manufacturer with an accompanying letter, stating the reason of the claim.
All claims put in, their brief description and measured taken are recorded in Table 1.

Table 1

Claim content	Reason, measures taken	Notes